Incommensurate Structures in the Group VIa Elements above 100Gpa

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The high-pressure behaviour of sulfur has long been known to be extremely complex, and it is only recently that it has begun to be simplified [1, 2]. The stable crystal structure at ambient conditions, S-I, comprises covalently-bonded S8-rings arranged in an orthorhombic structure [3]. Although S-I has been reported to undergo a gradual transition to an amorphous form on compression at room temperature [4-6], we observe S-I to transform directly to tetragonal S-II [7] at 38 GPa with no evidence of any intermediate amorphous phase. Single-phase diffraction profiles of S-III were observed above 95 GPa, and these revealed that S-III adopts the same incommensurately modulated monoclinic structure as Se-IV and Te-III. Sulfur is thus the first element observed to have an incommensurately modulated structure above 100 GPa. On pressure decrease a previously unreported phase of sulfur can be assigned to the triclinic structure of Se-III and Te-II. In this contribution we describe our most recent results on S-III and Se-II.

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Keywords: high-pressure crystallography, sulfur, phase transition